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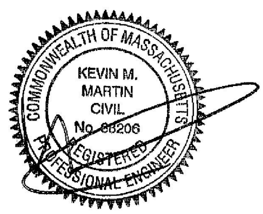
MEMORANDUM

TO: Adam Siegel
SGL Development
485 Massachusetts Avenue, Suite 302
Cambridge, MA 02139



FROM: Kevin M. Martin, P.E.
Geotechnical Engineer

DATE: July 12, 2018

RE: **GEOTECHNICAL SUMMARY REPORT**
PROPOSED RESIDENTIAL BUILDING
21 EASTMAN STREET
SOMERVILLE, MASSACHUSETTS

This memorandum report serves as a geotechnical summary report for the referenced project. The contents of this memorandum are subject to the attached ***Limitations***.

SITE & PROJECT DESCRIPTION

The site was formerly developed with a single-family residence which was recently razed to accommodate the project. KMM has no knowledge of past construction, use and/or development of the property. The site is located in a residential area atop a steep slope. The site is complicated by the presence of a steep hillside slope to the rear of the property. The slope is about ≈30-35 ft in height with an average steepness of about≈ 2H:1V (steeper near the crest; flatter at the base). Based on review of the *Site Plan*, site grades vary from elevation ≈67-103 ft. There is a ≈6-7 ft concrete retaining wall near the crest of the slope; which will also be removed for the project.

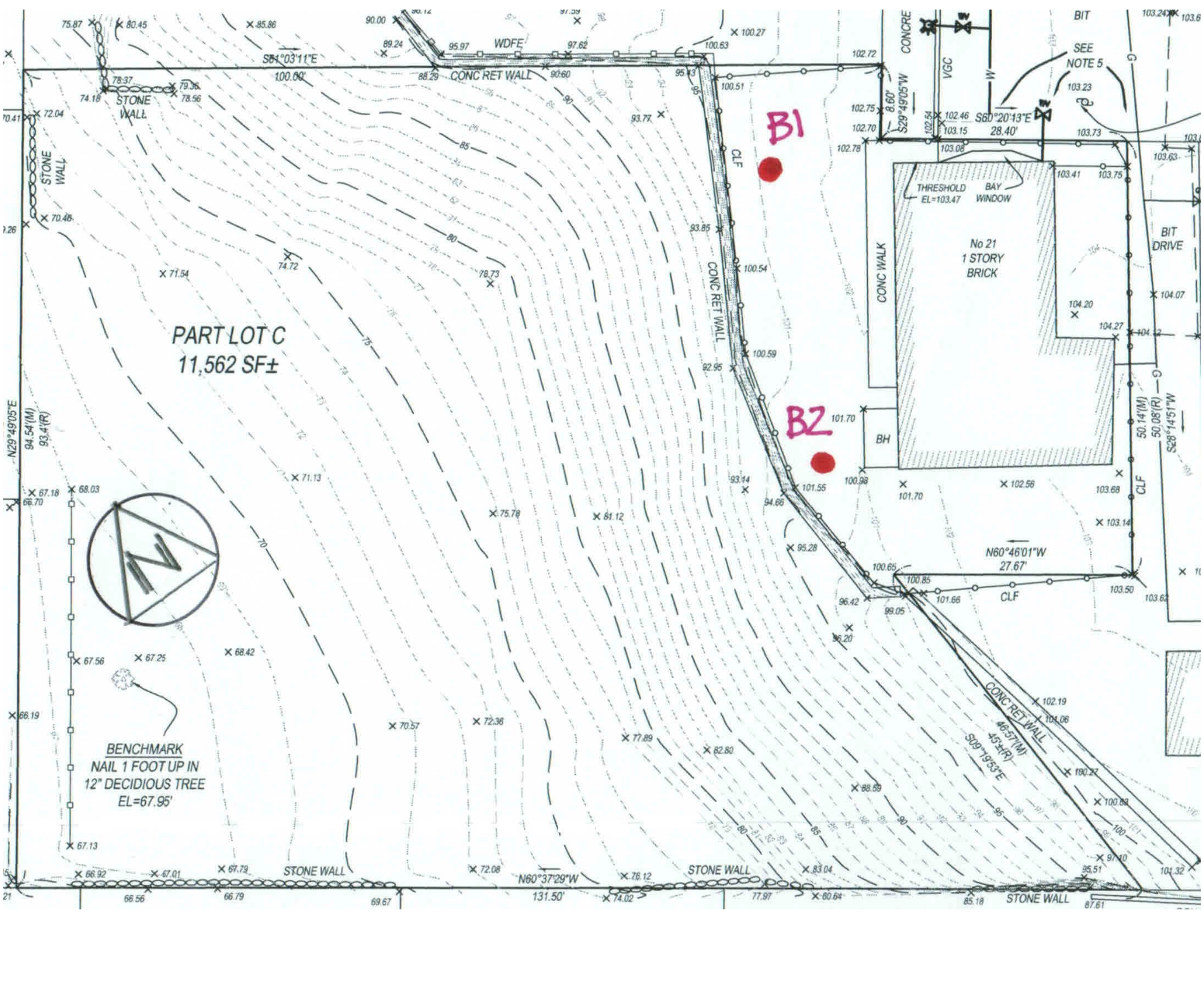
The project includes a three-story, wood-framed residential building that will overhang the slope. A large retaining wall will be necessary to accommodate site grading. It is intended to support the building on a conventional spread footing foundation. Significant grade change (ie: expansive fill) will be necessary for the project. The Fill will expand from ≈5-20 ft along the project periphery.

The purpose of this study is to review the subgrade conditions and provide a geotechnical evaluation related to foundation design and construction as required by the *Massachusetts State Building Code*. This report does not include an environmental assessment relative to oil, gasoline, solid waste and/or other hazardous materials. The environmental conditions of the property should be addressed by others as necessary. This study also does not include review of site design or construction issues such as infiltration systems, dry wells, retaining walls, slope stability, excavation support systems, underground utilities, shoring, temporary crane pads, retaining walls, detention ponds, protection of surrounding buildings/utilities or other site and/or temporary design unless specifically addressed herein.

SUBSURFACE EXPLORATION PROGRAM

Test Borings

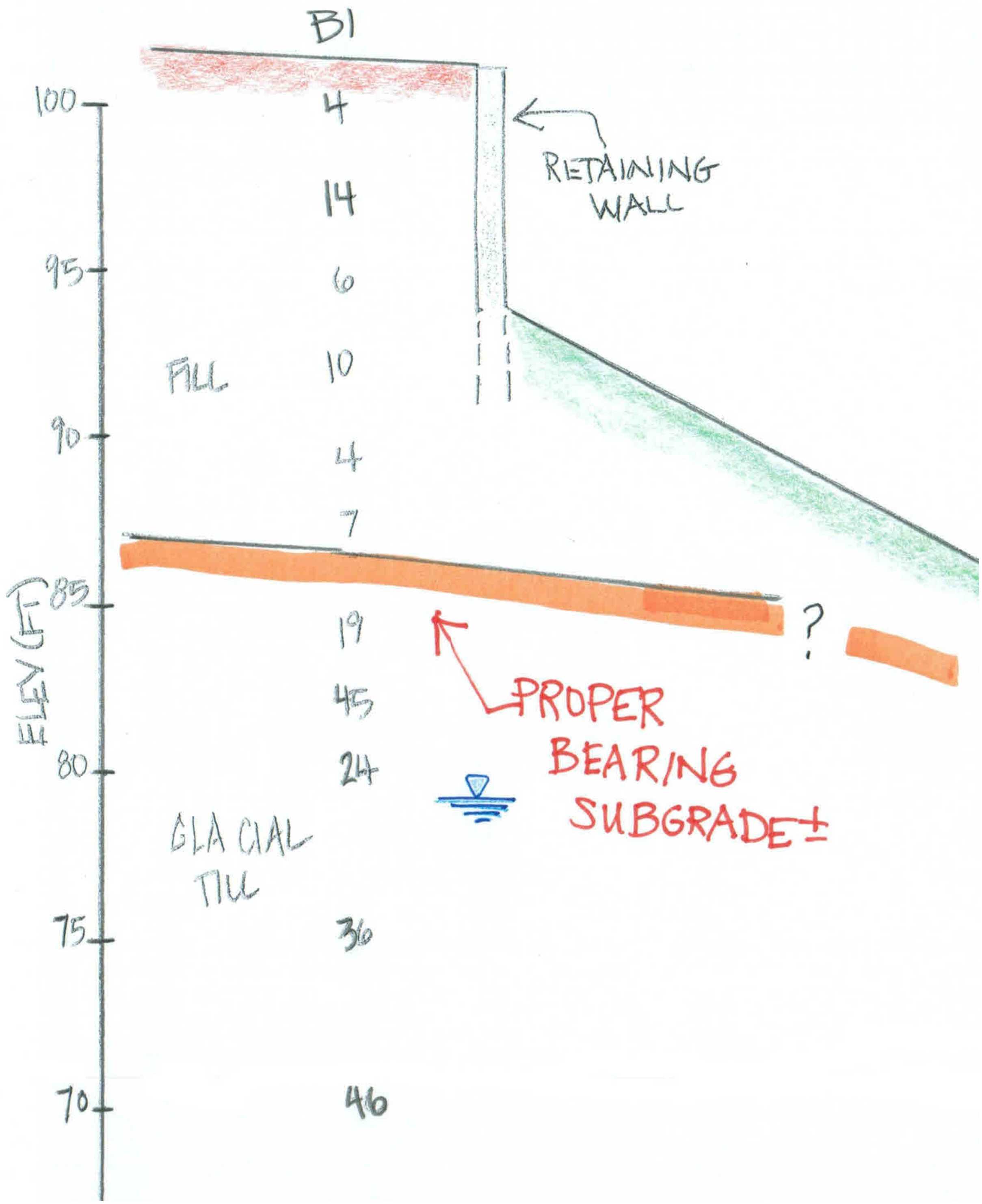
The exploration program for the project included two (2) test borings <u>where accessible</u> (at the top of the slope). It should be recognized that the subgrade conditions were not reviewed in over half the project area given limited access. The test borings (B1 & B2) were advanced to depths of ≈28-32 ft utilizing 4¼ inch continuous flight hollow stem augers. Soil samples were typically retrieved at no greater than 5 ft intervals with a 2 inch diameter split-spoon sampler. Standard Penetration Tests (SPTs) were performed at the sampling intervals in general accordance with ASTM-D1586 (*Standard Method for Penetration Test and Split-Barrel Sampling of Soils*). Field descriptions and penetration resistance of the soils encountered, observed depth to groundwater, depth to refusal and other pertinent data are contained on the attached *Test Boring Logs*.



TEST BORE LOCATIONS

SUBSURFACE CONDITIONS

The subsurface conditions below (1) Undocumented Fill include (2) stable Glacial deposits. A *Subsurface Profile* depicting the soil and groundwater conditions is attached for review.



There is about ≈12-15 ft of Undocumented Fill at the test locations. The Fill varies in composition but generally includes a brown, silty Sand, little gravel with trace amounts of brick, rubble, organic and other matter. The Fill is generally sandy in composition. The Fill is loose and unstable suggesting limited compaction. Other Fill may be present on the site given the hillside contour and past construction.

The parent site soils include stable Glacial soils. These include a brown, well-graded, fine to medium Sand with some to little gravel and silt, occasional cobbles. The fine-grained composition of the glacial soils renders them poor-draining, moisture sensitive and frost susceptible. The Glacial soils are stable, dense and compact.

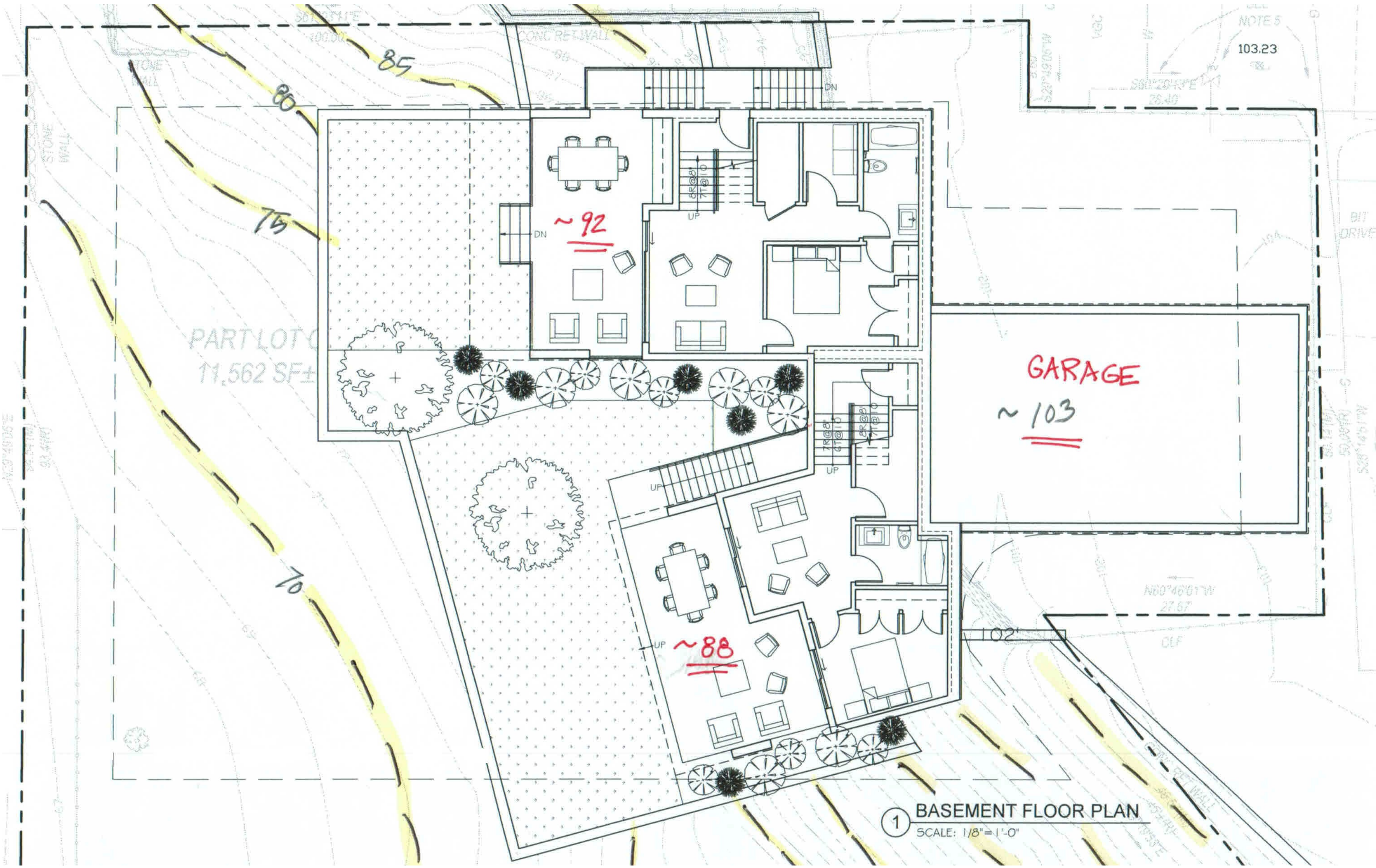
Groundwater was encountered in some of the test bores at depths of ≈14-16 ft below grade. Wet soils were present at these depths. It should be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, utilities and other factors differing from the time of the measurements. This study was completed at a time of seasonally normal groundwater.

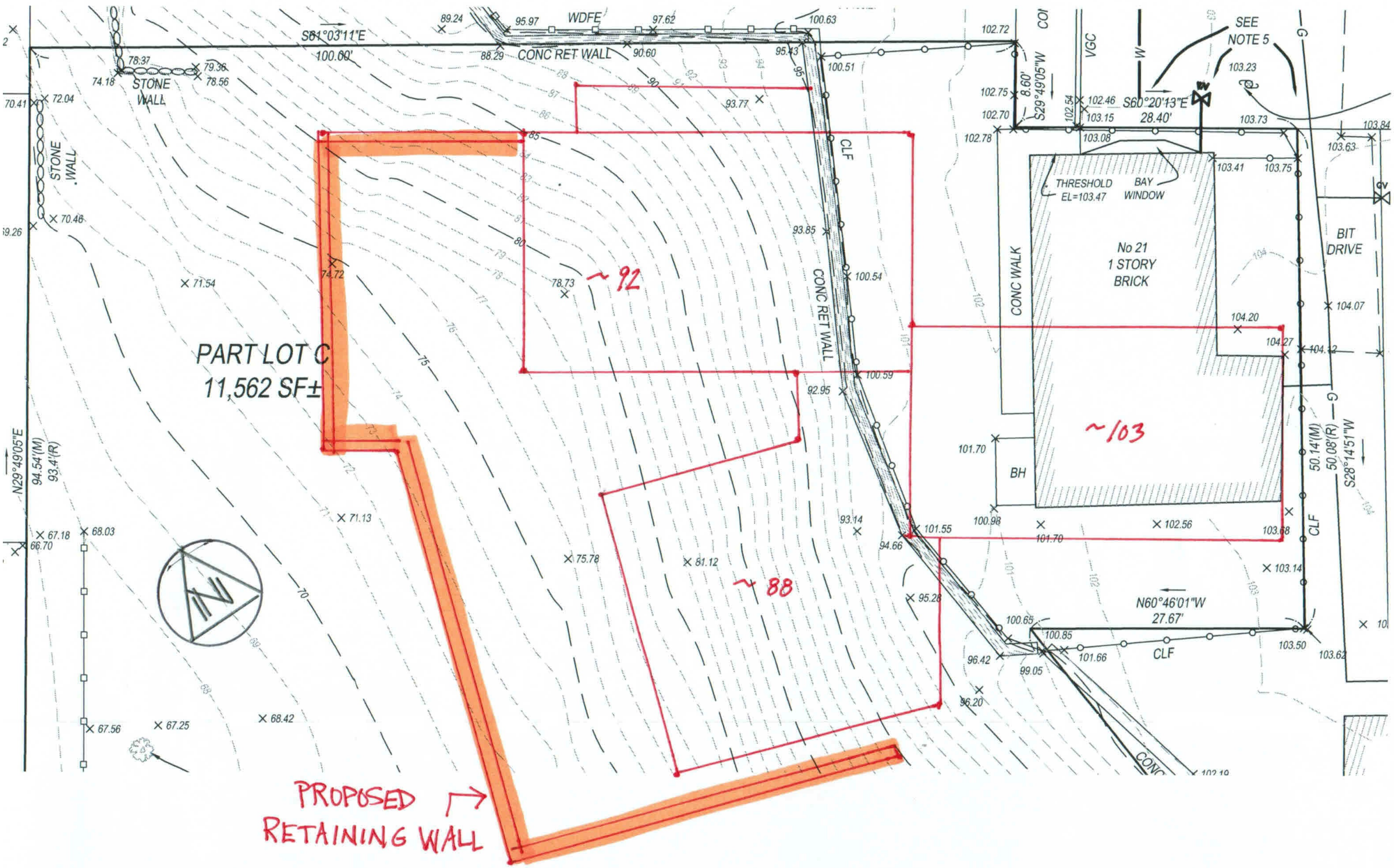
FOUNDATION SUBGRADE RECOMMENDATIONS

The subgrade conditions are favorable for supporting the proposed building on a conventional spread footing foundation with a concrete floor slab. The undocumented fill, organic laden soils, intersecting utilities, abandoned foundations and other questionable materials shall be fully removed from the building pad including the *Footing Zone of Influence* (*FZOI*) to expose the Glacial subgrade. The *FZOI* is defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay. Structural Fill shall conform to the attached Specifications (Table 1). Expansive structural fill will be necessary to grade the hillside contour.

The parent subgrade soils (Glacial) should be exposed in the foundation areas prior to casting the footings or placing structural fill. It is recommended that the parent subgrade soils be proof-rolled with vibratory densification and exhibit stable and compact conditions. The purpose of the proof-rolling is to densify the site soils and identify potential loose or unstable areas which should be removed as necessary. Proof-rolling should involve at least 4-5 passes with a vibratory compactor (minimum 950 pound static weight) operating at peak energy. During the proof rolling process, the subgrade should be observed by an Engineer to identify areas exhibiting weaving or instability. It will be necessary to remove weakened or unstable soils and replace with a Structural Fill or crushed stone. Wet conditions and subgrade stability are typically more problematic if construction occurs during the wetter winter or spring season. The drier summer months are more favorable for groundwater control.

The subgrade should ultimately be stable, dewatered, compact and protected from frost throughout construction. Bearing subgrades that become weakened or disturbed due to wet conditions will be rendered unsuitable for structural support. The Contractor shall ultimately be responsible for the means and methods of temporary groundwater control, subgrade protection and site stability during construction. An Engineer from KMM should be scheduled to review the foundation subgrade conditions and preparation during construction.


GARAGE
~103
~92
~88
85
80
75
70
PART LOT C
11,562 SF±
STONE WALL
CONC RET WALL
103.23
NOTE 5
BIT DRIVE
N60°46'01"W
27.67'
DN
UP
1 BASEMENT FLOOR PLAN
SCALE: 1/8"=1'-0"


S61°03'11"E
100.00'
CONC RET WALL
WDFE
STONE WALL
PART LOT C
11,562 SF±
N29°49'05"E
94.54'(M)
93.4'(R)
CLF
CONC RET WALL
~92
~88
~103
No 21
1 STORY
BRICK
THRESHOLD
EL=103.47
BAY WINDOW
CONC WALK
BH
BIT DRIVE
SEE NOTE 5
S60°20'13"E
28.40'
8.60'
S29°49'05"W
N60°46'01"W
27.67'
50.14'(M)
50.08'(R)
S28°14'51"W
PROPOSED
RETAINING WALL


RETAINING WALL
GROUND FLOOR
PATIO
FILL
GLACIAL TILL
ELEV (FT)
EXISTING GRADE
STRUCTURAL FILL
PROPOSED RETAINING WALL

FOUNDATION DESIGN RECOMMENDATIONS

The footings are expected to gain bearing support atop the parent soils and/or compacted structural fill. Footings may be designed using an allowable bearing capacity of 4 ksf (FS=3). The allowable bearing capacity may be increased a third (⅓) when considering transient loads such as wind or seismic. The bearing capacity is contingent upon the perimeter strip footings and isolated column footings being no less than 2 ft and 3 ft in width respectively. For footings less than 3 ft in lateral dimension, the allowable bearing capacity should be reduced to one-third and multiplied by the least lateral footing dimension in feet. Foundation settlement should be less than 1 inch with differential settlement less than ½ inch. The settlement should be elastic and occur during construction. Exterior footings shall be provided with at least 4 ft of frost protection. Proper frost protection should be necessary during winter construction.

Recommendations for the lateral earth pressure against the unbalanced walls and drainage control are outlined on Table 2.

The subsurface conditions were reviewed with respect to seismic criteria set forth in the ***Massachusetts State Building Code***. Based on the relative density of the soils and the depth to groundwater, the site is not susceptible to liquefaction in the event of an earthquake (*Section 1804.6*). Based on interpretation of the *Building Code*, the *Site Classification* is "D" (Stable Soil Profile).

It is recommended that a minimum 8-inch base of *Gravel Base Fill* (Table 1) be placed below the ground floor slab for moisture and frost control. The gravel base shall be increased to no less than 12 inches for exterior concrete slabs exposed to frost as well as the garage level slab (≈18 inches at ramps and entrances). A subgrade modulus of 150 pci may be used for design of the floor slab. A vapor retarder should be used below the floor slab dependent upon the floor treatment. A vapor barrier should be specified by others per ACI Standards. A typical vapor retarder may include minimum 10-mil polyethylene or StegoWrap™ with joints lapped 10 inches.

SITE DEVELOPMENT

Significant retaining walls will be required to accommodate site grading on the hillside contour. Unbalanced walls about ≈10-20 ft will be necessary in this regard. The walls will need to be selected, designed and specified by others for the project. We provide the following comments in regards to geotechnical aspects of the walls.

- The internal, external and global stability of the walls shall be reviewed by others. The Walls shall be designed in accordance with the *MSBC* and other acceptable standards (NCMA Standards).

- The wall shall be backfilled with compacted *Structural Fill* (Table 1). All compacted soils should be densified to at least 95% relative compaction per the Modified Proctor Test (ASTM D1557). Compacted soils should be densified within ±2% of optimum moisture.

- The following soil parameters may be used for design of the wall:

I. Reinforced Earth Zone			
Structural Fill (Table 1)	Friction Angle (φ)	=	34°
	Unit Weight (γ)	=	125 pcf
II. Retained Backfill			
Structural Fill (Table 1)	Friction Angle (φ)	=	34°
	Unit Weight (γ)	=	125 pcf
III. Foundation Soils			
Glacial Till	Friction Angle (φ)	=	35°
	Unit Weight (γ)	=	130 pcf

$f = \tan(\delta)$, where δ is the interface friction angle for sliding

- Mass concrete against the following soils

Structural Fill (Table 1)	0.50
Glacial Till	0.40

- The Fill and Organic laden soils shall fully stripped from all areas. The exposed subgrade shall be proof-rolled with heavy vibratory compaction (minimum 2-ton static weight) making at least 5-6 passes. The subgrade should ultimately exhibit stable and compact conditions.

- We recommend an embedment of at least 30 inches at the base of the wall. The minimum embedment shall also be in accord with the NCMA.

- The walls should consider seismic and surcharge loads in the design. Surcharge loads may include steep back slopes, traffic and building loads. We recommend a traffic surcharge no less than 250 psf where travel is allowed near the wall. Footing loads will need to be considered in some areas.

- The walls should be designed for seismic load per the *Massachusetts State Building Code*.

- Storm water should not be allowed behind the walls. This includes infiltration systems, dry wells, roof gutters, etc. Excess water pressure is often the result of failure of these walls. The back of the wall is considered the back of the geogrid reinforcement (not the segmental block face). The Site Engineer should maintain water away from the walls.

- The walls should have proper internal drainage.

- Global stability should be reviewed for the project given the hillside contour and some steep slopes to the front of the wall. Global stability is generally addressed with longer geogrid reinforcement and/or additional toe embedment.

CONSTRUCTION CONCERNS

The contractor should be required to maintain a stable-dewatered subgrade for the building foundations and other concerned areas during construction. Subgrade disturbance may be influenced by excavation methods, moisture, precipitation, groundwater control and construction activities. The glacial soils are considered vulnerable to potential disturbance when exposed to wet conditions and construction activities. The moisture concerns are related to the higher percentage of fine-grained soil (fine sand & silt) that restricts water flow. The contractor should understand these concerns and take precautions to reduce subgrade disturbance. Such precautions may include diverting storm run-off away from construction areas, reducing traffic in sensitive areas, minimizing the extent of exposed subgrade if inclement weather is forecast, backfilling footings as soon as practicable and maintaining an effective dewatering program. Soils exhibiting weaving or instability should be over-excavated to a competent bearing subgrade then replaced with a free draining structural fill or crushed stone. The moisture concerns are typically more problematic if construction takes place during the winter to spring season or other periods of inclement weather. A protective base of ¾-inch minus crushed stone may be placed ≈6 inches below and laterally beyond the footing limits for protection during construction. The stone base is to protect the site soils, facilitate any necessary dewatering and provide a dry/stable base upon which to progress foundation construction. The protective base should be considered elective and dependent upon the site conditions. The stone base should be considered necessary if wet conditions are encountered at footing grade. The protective stone base shall be tamped with a plate compactor and exhibit stable conditions.

The groundwater table, if encountered, will need to be temporarily controlled during construction to complete work in dry conditions and protect the competency of the subgrade. The groundwater or puddled storm water are expected to be controlled with conventional filtered sumps and submersible pumps. The groundwater table should be continuously maintained at least one foot below construction grade until backfilling is complete. The temporary sumps should be filtered with stone and fabric and extend at least 20 inches below construction grade. A ≈6 inch lift of ¾-inch minus crushed stone should be placed atop the wet subgrade to protect its competency and facilitate dewatering. The stone base should have positive slope to the sump. Adequate dewatering and storm water management are necessary for maintaining the competency of the site soils.

The subgrade should ultimately be stable, dewatered, compact and protected from frost throughout construction. Bearing subgrades that become weakened or disturbed due to wet conditions will be rendered unsuitable for structural support. The Contractor shall ultimately be responsible for the means and methods of temporary groundwater control, subgrade protection and site stability during construction. An Engineer from KMM should be scheduled to review the foundation subgrade conditions and preparation during construction.

CONSTRUCTION MONITORING

It is recommended that a qualified engineer or representative be retained to review earthwork activities such as the preparation of the foundation bearing subgrade and the placement/compaction of Structural Fill. It is recommended that KMM be retained to provide construction monitoring services. This is to observe compliance with the design concepts presented herein.

CLOSING COMMENTS

Subgrade exploration was limited to the front of the site given access issues. It is recommended that additional exploration (test bores or test pits) be completed to review conditions along the slope once accessible. This study only addressed the backfill and subgrade conditions around and below the retaining walls. The internal, external and global stability of the walls were reviewed by others. This study was solely to review the geotechnical design parameters considered for the wall design and building foundation. This study also does not include review of the wall geometry, drainage, geogrid and ancillary grading.

We trust the contents of this memorandum report are responsive to your needs at this time. Should you have any questions or require additional assistance, please do not hesitate to contact our office.

kmm50/Somerville21Eastman.wpd

LIMITATIONS

Explorations

1. The analyses, recommendations and designs submitted in this report are based in part upon the data obtained from preliminary subsurface explorations. The nature and extent of variations between these explorations may not become evident until construction. If variations then appear evident, it will be necessary to re-evaluate the recommendations of this report.

2. The generalized soil profile described in the text is intended to convey trends in subsurface conditions. The boundaries between strata are approximate and idealized and have been developed by interpretation of widely spaced explorations and samples; actual soil transitions are probably more gradual. For specific information, refer to the individual test pit and/or boring logs.

3. Water level readings have been made in the test pits and/or test borings under conditions stated on the logs. These data have been reviewed and interpretations have been made in the text of this report. However, it must be noted that fluctuations in the level of the groundwater may occur due to variations in rainfall, temperature, and other factors differing from the time the measurements were made.

Review

4. It is recommended that this firm be given the opportunity to review final design drawings and specifications to evaluate the appropriate implementation of the recommendations provided herein.

5. In the event that any changes in the nature, design, or location of the proposed areas are planned, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and conclusions of the report modified or verified in writing by KMM Geotechnical Consultants, LLC.

Construction

6. It is recommended that this firm be retained to provide geotechnical engineering services during the earthwork phases of the work. This is to observe compliance with the design concepts, specifications, and recommendations and to allow design changes in the event that subsurface conditions differ from those anticipated prior to the start of construction.

Use of Report

7. This report has been prepared for the exclusive use of SGL Development in accordance with generally accepted soil and foundation engineering practices. No other warranty, expressed or implied, is made.

8. This report has been prepared for this project by KMM Geotechnical Consultants, LLC. This report was completed for preliminary design purposes and may be limited in its scope to complete an accurate bid. Contractors wishing a copy of the report may secure it with the understanding that its scope is limited to preliminary geotechnical design considerations only.

TABLE 1

21 Eastman Street
Somerville, Massachusetts

Recommended Soil Gradation & Compaction Specifications

Gravel Base Fill
(Select Gravel Fill)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
3 inch	100
3/4 inch	60-90
No. 4	20-70
No. 200	2-8

NOTE: For minimum 8-inch base below Concrete Floor Slabs (in heated areas)
For minimum 12-inch base for concrete slabs exposed to frost
For minimum 18-inch base at ramps and entrances
Shall have less than 12% fines (No. 200 sieve) based on the Sand fraction

Structural Fill
(Gravelly SAND, little Silt)

SIEVE SIZE	PERCENT PASSING BY WEIGHT
5 inch	100
3/4 inch	60-100
No. 4	20-75
No. 200	0-12

NOTE: For use as structural load support below the foundations
For use as backfill behind unbalanced foundation/retaining walls
Shall have less than 25% fines (No. 200 sieve) based on the Sand fraction
A ¾-inch crushed stone may be used in wet conditions

Structural Fill placed beneath the foundation should include the *Footing Zone of Influence* which is defined as that area extending laterally one foot from the edge of the footing then outward and downward at a 1H:1V splay. Structural Fill should be placed in loose lifts not exceeding 12 inches for heavy vibratory rollers and 8 inches for vibratory plate compactors. Structural Fill on the project should be compacted to at least 95 percent of maximum dry density as determined by the Modified Proctor Test (ASTM-D1557). Fill shall be compacted within ±2 of the optimum moisture content. The adequacy of the compaction efforts should be verified by field density testing which is also a requirement of the *Massachusetts State Building Code*.

TABLE 2

21 Eastman Street
Somerville, MA

Recommended Lateral Earth Pressures & Drainage for Unbalanced Walls

Lateral earth pressures for the structural design and stability analysis of unbalanced foundation walls (basement walls, retaining walls, elevator pit, etc) are provided herein. The following table outlines the recommended lateral earth pressure coefficients and equivalent fluid weights:

WALL CONDITION	LATERAL TRANSLATION (Δ/H)	EARTH PRESSURE COEFFICIENT (K)	EQUIVALENT FLUID WEIGHT (γ_{EFW})
restrained	0	K_o	60 pcf
no restraint	0.002	K_a	35 pcf
no restraint	0.02	K_p (FS=3)	125 pcf
seismic	n/a	K_{eq}	see note

where: Δ = movement at top of wall by tilting or lateral translation
H = height of wall

The above lateral earth pressures are based upon:

1. Rankine earth pressure theory;
2. Retaining wall backfilled with Structural Fill (Table 1)
3. Unit weight of backfill less than 125 pcf
4. No hydrostatic pressures
5. No surcharge loading;
6. A level backfill in front and behind of wall;
7. Seismic loads distributed as an inverse triangle over the height of wall (*MSBC*);
8. Dynamic/compaction stresses accounted for with seismic pressures;
9. Soil backfill densified with plate compactors within 3 ft lateral distance of wall;
10. Top 2 ft should not be considered for passive resistance.

The lateral load due to seismic pressure shall be in accordance with *Section 9.5.2.9* of the *MSBC*. *Equation 9.5.2.9* shall be used to estimate the seismic force (F_w). The unit weight of the backfill used in this equation is 125 pcf (Structural Fill). There are no soils subject to liquefaction below and/or behind the wall.

The lateral resistance of retaining walls should also accommodate surcharge loads. Uniformly distributed loads should be superimposed along the face of the wall at a magnitude equal to the surcharge pressure multiplied by the appropriate earth pressure coefficient. Surcharge loads should be considered where they are located within a horizontal distance equivalent to 1.0 times the height of the wall. Anticipated point or line loads situated behind the wall should be evaluated in accordance with linear elastic theory.

For frost and drainage concerns, it is recommended that *Structural Fill* (Table 1) be placed directly behind the unbalanced walls. The ground surface immediately adjacent to the unbalanced foundation should be sloped away from the building to allow for positive drainage. It is also recommended that the surficial materials adjacent to the building be relatively impermeable to reduce the volume of precipitation infiltrating into the subgrade. Such impermeable materials include Portland cement concrete, bituminous concrete, or a vegetated silty topsoil. The purpose of the low permeable soils or barriers is to mitigate storm water flow towards the embedded foundation.

Unbalanced foundation walls should be provided with adequate footing drains per the *MSBC*. The drains should be located along the periphery of the footprint. The perimeter foundation drain should be located at least ≈2-4 inches above the bottom of footing elevation and six inches outward from the edge of footing. The drains should not encroach within the *Footing Zone of Influence* defined as that area extending laterally one foot from the edge of footing then outward and downward at a 1H:1V splay. Furthermore, the invert elevation of the drain should be at least 12 inches below the underside of the adjacent floor slab. The drains should consist of minimum 4 inch diameter, perforated PVC-SDR 35 drain pipe encased within 12 inches of ¾-inch stone and wrapped with a filter fabric such as Mirafi 140N or equal. The drains shall discharge to a storm drain system or day light if feasible. The Site Engineer should review the discharge of the drains. The drains should be provided with permanent clean-outs at convenient locations to facilitate access to all sections of the system. Clean-outs should be located at bends and no greater than 175 ft on-center. Roof gutters and other storm collection should not be discharged to the foundation drains. Recharge systems, infiltrators and/or dry wells shall be kept away from the basement level to prevent hydrostatic surcharge.

If the unbalanced foundation walls can not be drained to alleviate hydrostatic forces, then the lateral earth pressure equivalent fluid weight should be increased to 90 pcf. Such earth pressures should be used for the elevator pits, if necessary. This increased lateral pressure shall be used for areas where dry wells or infiltrators are necessary near the foundation.

The recommended friction factors to be used for retaining wall design are as follows:

<u>Recommended Friction Factor (f)</u>
$f = \tan(\delta)$, where δ is the interface friction angle

- Concrete against the following soils

Structural Fill (Table 1)	0.50
Glacial Till Soils	0.50

TEST BORING LOG

SHEET 1

Soil Exploration Corp. Geotechnical Drilling Groundwater Monitor Well 148 Pioneer Drive Leominster, MA 01453 978 840-0391	**Proposed Building** **Site 21 Eastman Road** **Somerville, MA.**	BORING B-1 PROJECT NO. 18-0612 DATE: June 18, 2018

Ground Elevation:	
Date Started:	June 15, 2018
Date Finished:	June 15, 2018
Driller:	DL
Soil Engineer/Geologist:	

GROUNDWATER OBSERVATIONS			
DATE	DEPTH	CASING	STABILIZATION
6/15/18	20 ft	n/a	Upon Completion

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	7"	0'0" – 2'0"	1-2-2-5		Dark Brown, silty Sand w/ gravel, trace brick, rubble
		2	5"	2'0" – 4'0"	4-6-8-6		Sand & Gravel, concrete, dry
5		3	3"	5'0"- 7'0"	3-3-3-5		
		4	5"	7'0" – 9'0"	6-6-4-4		Brown, fine to medium Sand, little silt, little gravel (FILL)
10		5	12"	10'0" - 12'0"	2-2-2-3		
		6	4"	12'0" – 14'0"	3-4-3-4		Brown, f-m Sand, little silt, little gravel, trace loam (FILL)
						15'6"	
15		7	3"	15'0" - 17'0"	5-7-12-10		Brown, f-m Sand & Gravel, some silt
		8	19"	17'0" – 19'0"	29-21-24-18		
20		9	18"	20'0" – 22'0"	7-12-12-14		Brown, fine to medium Sand, some silt, little gravel (GLACIAL TILL)
25		10	21"	25'0" – 27'0"	16-17-19-15		Brown, fine to medium Sand, some silt, little gravel, wet
30		11	24"	30'0" – 32'0"	10-16-30-19		Brown, fine to medium Sand, some silt, little gravel, wet
							End of boring at 32 ft
35							
39							

Notes: Hollow Stem Auger Size 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose,	Trace 0 to 10%		CASING	SAMPLE	CORE TYPE
10 -30 M Dense, 30 -50 Dense, 50+ V	Little 10 to 20%	ID SIZE (IN)		SS	
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M	Some 20 to 35%	HAMMER WGT (LB)		140 lb.	
8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.	And 35% to 50%	HAMMER FALL (IN)		30"	

TEST BORING LOG

SHEET 2

Soil Exploration Corp. Geotechnical Drilling Groundwater Monitor Well 148 Pioneer Drive Leominster, MA 01453 978 840-0391	**Proposed Building** **Site 21 Eastman Road** **Somerville, MA.**	BORING B-2 PROJECT NO. 18-0612 DATE: June 18, 2018

Ground Elevation:
Date Started: June 15, 2018
Date Finished: June 15, 2018
Driller: DL
Soil Engineer/Geologist:

GROUNDWATER OBSERVATIONS			
DATE	DEPTH	CASING	STABILIZATION

Depth Ft.	Casing bl/ft	Sample No.	Pen/Rec	Depth	Blows/6"	Strata	Visual Identification of Soil and / or Rock Sample
1		1	10"	0'0" – 2'0"	2-3-2-2		Dark Brown, loamy, silty Sand, little gravel
		2	0"	2'0" – 4'0"	1-2-2-3		
5		3	10"	5'0"- 7'0"	2-2-3-5		Brown, fine to medium Sand, little silt, trace gravel (FILL)
		4	10"	7'0" – 9'0"	3-5-2-5		
10		5		10'0" - 12'0"	4-2-3-2		Brown, f-m Sand, little gravel, little silt (FILL)
		6	20"	12'0" – 14'0"	11-15-16-15	12'	
							Brown, fine to medium Sand, some silt, little gravel
15		7	20"	15'0" - 17'0"	5-9-11-9		
							(GLACIAL TILL)
20		8	17"	20'0" – 22'0"	5-9-14-15		Brown, fine to medium Sand, some silt, little gravel, wet
25		9	21"	25'0" – 27'0"	9-12-22-25		Brown, fine to medium Sand, some silt, little gravel, wet
							Auger Refusal at 28 ft No water encountered upon completion
30							
35							

Notes: Hollow Stem Auger Size 4-1/4"

Cohesionless: 0 - 4 V. Loose, 4 - 10 Loose,	Trace	0 to 10%		CASING	SAMPLE	CORE TYPE
10 -30 M Dense, 30 -50 Dense, 50+ V	Little	10 to 20%	ID SIZE (IN)		SS	
Cohesive: 0 -2 V Soft, 2 -4 Soft, 4 -8 M	Some	20 to 35%	HAMMER WGT (LB)		140 lb.	
8 -15 Stiff, 15 -30 V. Stiff, 30 + Hard.	And	35% to 50%	HAMMER FALL (IN)		30"	


WATER